RESORT NO. 1 - PRELIMINARY SOIL REPORT

MAUNALUA, OAHU, HAWAII
TAX MAP KEY: 3-9-11

To:
KAISER-AETNA

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

September 24, 1970

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

WALTER LUM
EDWARD WATANABE
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3030 WAIALAE AVE., HONOLULU, HAWAII 96816 • TEL. 737-7931

September 24, 1970

KAISER-AETNA
P. O. Box 2997
Honolulu, Hawaii 96802

Gentlemen:

Subject: Resort No. 1
Preliminary Soil Report
(for site grading design purposes)
Maunalua, Oahu, Hawaii
Tax Map Key: 3-9-11
Chapter 23, Revised Ordinances of
Honolulu, 1961 As Amended

The Resort Division area consists of resort, apartment and residential subdivisions.

In accordance with your request, preliminary soil explorations were made to cover the general area. This report concerns only the preliminary soil explorations at the site for the proposed Resort No. 1, Maunalua, Oahu, Hawaii. The site is on the beach fronting Wawamalu Beach.

The borings generally indicated surface layers of silty sand and coral underlain by lava rock. Rock outcrops were noted in several places along the bank of the stream north of the site and generally along the shoreline.

Some grading and filling of the site are contemplated. The earthwork should be done in accordance with the requirements of Chapter 23, Revised Ordinances of Honolulu, 1961 As Amended and the recommendations contained herein.

Light apartment structures may be constructed with ordinary footings or foundations.

Because lava rock may be encountered relatively close to the surface, high-rise buildings may be constructed with relatively simple foundations. The depth of the rock formation was not determined for this report. More explorations should be made for the design of a specific structure and location.

The report includes a Boring Location Plan, boring logs, laboratory test results, recommendations and limitations.

Respectfully submitted,

WALTER LUM ASSOCIATES, INC.

Ezra Koike

Ezra Koike
Professional Engineer
Hawaii No. 1450

EK:vl

C O N T E N T S

RESORT NO. 1 - PRELIMINARY SOIL REPORT

MAUNALUA, OAHU, HAWAII
TAX MAP KEY: 3-9-11

SCOPE OF EXPLORATION

The Resort Division area consists of resort, apartment and residential subdivisions. This report concerns only the preliminary soil explorations at the site for the proposed Resort No. 1 at Maunalua, Oahu, Hawaii. The purpose of this exploration was to determine general soil conditions for site grading design purposes.

This report includes field exploration, laboratory tests and general recommendations for site grading and light building foundation design.

FIELD EXPLORATION

Nine borings were made at the site. The locations of these borings are shown on Figure 1, Boring Location Plan.

The borings were made with 3 and 4-in. diameter augers using tungsten carbide bits. Soil samples were recovered with a standard split spoon driven with a 140-lb hammer falling 30 inches.

Soil samples were visually observed and subjected to appropriate tests in the laboratory. Based on visual observations and laboratory tests, the soil descriptions in the boring logs are generally made in accordance with the "Unified Soil Classification System."

LABORATORY TESTS

Laboratory tests for on-site soils included: natural water content, Atterberg limits, specific gravity, sieve analysis, AASHO T-180-57 density, expansion and CBR.

A list of the standard field and laboratory test methods used for this project is given in the Appendix.

A summary of the laboratory test results is given in Table IA.

GENERAL SITE CONDITIONS

The proposed resort site is along the shoreline east of the Golf Course Subdivision No. 6, makai of Kalanianaole Highway and south of Resort No. 2 and Wawamalu Stream. A partially paved access road runs into the property about 100 ft east of and parallel to Kalanianaole Highway. Several trails and dirt roads cross the site.

The surface soils consist of mostly beach sand. Salt water plants cover most of the area. The site generally slopes toward the ocean at about a 2 to 5% gradient. A beach of sand and coral fragments and lava outcrops form the shoreline of the site.

Lava outcrops were also noted along the stream banks of Wawamalu Stream north of the site.

INTERPRETATION OF SOIL CONDITIONS

From the field exploration, the soils at the site may be described as follows:

A thin surface layer of about 1 to 3 ft of loose silty sand with gravel and coral fragments underlain by lava rock to about 10 to 15 ft, the depths drilled.

The dune sand along the beach is as much as 10 or more feet deep in several places.

Water was noted only in Boring No. 79 next to Wawamalu Stream at about 4-ft depth during the field exploration. Because the resort area is exposed to open water, ground water level will probably vary closely with the tidal variations.

For more detailed descriptions of soils encountered in the drill holes, refer to the boring logs.

DISCUSSION AND RECOMMENDATIONS

The proposed plan is to grade the site for resort development with fills generally less than 15 to 20 ft in height.

Site Grading

All surface vegetation and miscellaneous debris should be cleared and removed prior to site filling. Localized soft pockets encountered during site preparations should be

excavated and backfilled with compacted select material. Provisions to drain the site should be included during and after the completion of filling operations.

Grading work should be done in general conformance with the requirements of Chapter 23, Revised Ordinances of Honolulu, 1961 As Amended.

For the construction of fills, the following is recommended:

1. Rubble, loose boulders and unsuitable materials should be removed.

2. Stockpiles and loose surface soils should generally be removed or scarified and recompacted before the placement of fills.

3. Hard surfaces along existing access roads should be scarified down to stiff soils and recompacted to match the density of the surrounding soils.

4. Fill material may be approved on-site or borrow soils. If practicable, fill material imported to the site should be select soils with a plasticity index generally less than 20.

5. Fills should be constructed in approximately level layers starting at the lower end and working upward. Where fills are made on sloping areas steeper than about 5 horizontal to 1 vertical, the ground at the toe of the fill should be benched to a generally level condition. As the fill is brought up, it should be continually keyed into the stiff natural ground by cutting steps into the slopes and compacting the fill into these steps.

6. Fills should be laid in 6-in. compacted layers with a relative density of at least 90% of AASHO T-180-57 density.

7. If clay (adobe) soils are used for fills, they should be placed preferably below 2 ft of finish grades and several feet from the face of fill slopes. See sketch attached, Figure 2.

8. If boulders are proposed to be used in the construction of fills, they should generally be placed along the toe sections of fill slopes and outside of probable building sites.

Before placing any boulders, the subgrade should be stripped to stiff natural ground and shaped to drain. The void spaces between boulders should be filled with granular material. A blanket of filter material should be placed between the boulders and any earth fills placed against boulders. See attached sketch Figure 3.

Slopes

In general, cut and fill slopes of 2 horizontal to 1 vertical or flatter should be used.

For low cuts thru mixtures of rock and clinkers, slope ratios of 1-1/2 horizontal to 1 vertical or flatter may be used.

For low cuts (less than 5± ft in height) in rock that is fairly continuous, slope ratios of 3/4 horizontal to 1 vertical or flatter may be used.

If slope heights (top to toe) of greater than 15 ft are considered, 8-ft wide benches should be placed at height intervals of about 15 ft in both cuts and fills.

For protection against erosion, the runoff from rainstorms should be diverted by berms or ditches away from slopes whenever practicable.

The surface of fill slopes should be compacted by cat-tracking or with a sheepsfoot roller.

In general, slope planting is recommended on cut and fill slopes to minimize erosion.

Foundations

Light short-span apartment type structures may be constructed at the site with ordinary footings or foundations.

Because lava rock may be encountered relatively close to the surface, high-rise buildings may be constructed with relatively simple foundations. The depth of the rock formation was not determined for this report. More explorations should be made for the design of a specific structure and location.

For heavy or long-span or multiple story structures, foundation explorations should be made at each building site to evaluate the ground conditions before foundations are designed.

The following may be used as a guide for foundation design for light short-span structures:

1. Bearing values for a given soil vary with the size and depth of footings. For light, one and 2-story, short-span structures, bearing values of about 2000 p.s.f. may be used.

2. If soft spots or pockets of loose material are encountered in footing excavations or below a building area, they should be excavated and replaced with compacted select on-site or borrow soils.

3. Foundation design adjustments must be made if adobe soils are encountered or imported. Care should be taken that there is at least 2 ft of compacted select material below building footings in adobe areas.

4. Concrete slab on ground should be placed over a base course of 4 in. of well-graded gravel less than 3/4 in. and greater than 1/4 in. in size. The subgrade should be compacted and shaped to a level surface or to drain, if practicable, and generally should be kept slightly higher than the finish grade outside of the building.

5. In general, buildings and structures should be placed about 15 ft from the tops of slopes.

6. Construction of retaining walls on slopes should generally be avoided.

7. Good surface drainage away from the foundation of structures should be maintained and the site should be graded at all times to prevent ponding of water.

Roadway

In general, a rough estimate of the roadway pavement thickness for the light residential traffic anticipated is as follows:

1. Wearing course - 2-in. asphaltic concrete.

2. Base course - 6-in. base course over a prepared subgrade of sandy on-site soils.

Provisions should be made in the contract documents to allow for local adjustments regarding subbase requirements in the field as ground conditions are exposed at subgrade levels. The subbase thickness will depend upon the type of material within the top 2 ft of subgrade.

The subgrade should be compacted and shaped to drain. To avoid the ponding of water and softening of the subgrade at low points, weep holes should be placed at subgrade levels through the walls of catch basins which are placed in these low areas.

Utilities

Although the probability of differential settlements in localized areas is slight in this area, utilities should be placed after the fills are constructed. Utility lines should be designed with flexible joints, particularly where lines are connected to structures. Gravity flow lines should be made as steep as practicable.

Unforeseen or undetected conditions may occur in localized areas and will have to be adjusted and corrected in the field as they are detected.

PROPOSED SPECIFICATION FOR EARTHWORK

RESORT NO. 1

General Description

This item shall consist of clearing and grubbing, removing of existing structures, preparing of land to be filled, excavating and filling of the land, spreading, compacting and testing of the fill, and subsidiary work necessary to complete the grading.

Clearing, Grubbing and Preparing Areas to be Filled

Vegetation, concrete slabs and rubbish shall be removed and disposed of, leaving the disturbed area with a neat, debris-free appearance.

Vegetable matter shall be removed from the surface upon which fill is to be placed. Topsoil and stockpiled soils shall be (1) stripped to stiff natural ground or (2) scarified and recompacted before the placement of fills. Topsoil encountered at finish grade shall be scarified and recompacted.

Hard surfaces along the existing access roads shall be scarified down to stiff soils and recompacted to match the density of the surrounding soil before the placement of fills.

Where fills are proposed in sidehill areas, loose material along the bottom and the sides shall be stripped down to stiff natural ground before the placement of fills. New fills shall be keyed into the stiff natural ground.

Where fills are made on sloping areas steeper than 5 horizontal to 1 vertical, the ground at the toe of the slope shall be benched to a generally level condition. As the fill is brought up, it shall be continually keyed into the stiff natural ground by the cutting of steps into the hillside and compacting the fill into these steps. Ground slopes which are flatter than 5 horizontal to 1 vertical shall be benched when considered necessary by the Soil Engineer.

Materials

Fill materials shall consist of approved on-site or borrow soils. The soils shall contain no more than a trace of organic matter. Fill material imported to the site shall be select soils with a plasticity index less than 20.

Placing, Spreading and Compacting Fill Material

The selected fill material shall be placed in level layers which, when compacted, shall not exceed 6 inches. Each layer shall be spread evenly and thoroughly blade-mixed during the spreading to insure uniformity of material and water content within each layer.

No rocks or cobbles shall be allowed to nest and voids between rocks must be carefully filled and compacted with small stones or earth.

When the water content of the fill material is well below the optimum for compacting purposes, water shall be added until the water content assures a thorough bonding during the compacting process.

When the water content of the material is well above the optimum for compacting purposes, the fill material shall be aerated by blading or by other satisfactory methods until the water content is near the optimum.

After each layer has been placed, mixed and spread evenly, it shall be thoroughly compacted to no less than 90% of maximum density in accordance with AASHO Test No. T-180-57 or other comparable density tests. Compaction shall be with sheepsfoot rollers, multiple-wheel pneumatic-tired rollers or other acceptable rollers which shall be able to compact the fill to the specified density. Rolling shall be accomplished while the fill material is near the optimum water content. The rolling of each layer shall be continuous over its entire area and the roller shall make sufficient passes to insure the obtainment of the desired density.

Field density tests shall be made to get an indication of the compaction of the fill. Where sheepsfoot rollers are used, the soil may be disturbed to a depth of several inches. Density readings shall be taken as often as necessary in the compacted material below the disturbed surface. When these readings indicate that the density of any layer of fill or portion thereof is below the required 90% density, that layer or portion shall be reworked until the required density has been obtained.

The fill operation shall be continued in 6-in. compacted layers as specified above, until the fill has been brought to the finished slopes and grades as shown on the accepted plans.

Excavation

Suitable material from excavation shall be used in the fill and unsuitable material from excavation shall be disposed of.

Boulder Fills

If boulders are proposed to be used in the construction of fills, they shall be placed along the toe section of slopes and at locations indicated on the plan. The subgrade shall be stripped to stiff natural ground and shaped to drain. All voids between boulders shall be filled with smaller granular soils. A blanket of filter material shall be placed against the boulder fill before construction of earth fills behind or above the boulders.

Unforeseen Conditions

If unforeseen or undetected critical soil conditions such as soft spots are encountered during the field operation, corrective measures shall be made in the field as they are detected.

Rainy Weather

No fill material shall be placed, spread or rolled during unfavorable weather conditions. When the work is interrupted by heavy rain, fill operations shall not be resumed until field tests indicate that the water content and density are as previously specified.

BORING LOGS

Symbols

Symbols used generally are in accordance with the Unified Soil Classification System.

Where a parenthesis "(MH)" is used, the soil sample was classified by visual observation of the sample recovered.

Where no parenthesis "MH" is used, the soil sample was classified from either the Atterberg limits or sieve analysis test results.

WALTER LUM ASSOCIATES

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: RESORT NO. 1

LOCATION: Maunalua, Oahu, Hawaii

Tax Map Key: 3-9-11

HAMMER:
Weight: 140#
Drop: 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 71 Sheet No. ____ of ____

Driller: W. Lum Assoc. Date: 4-1-70

Field Party: KAKU, GLORY

Type of Boring: AUGER (ACKER ACE) Diam.: 3"

Elev.: 14.5' ± * Datum: —

Drill Bit: T.C. DRAG

Water Level: NOT NOTICED

Time: —

Date: 4-1-70

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: STANDARD PENETRATION TEST, Blows Per Foot (0 10 20 30)
SP-SM	LOOSE, BROWN, SILTY SAND W/ GRAVEL									
(MH)	STIFF, REDDISH BROWN CLAYEY SILT W/ GRAVEL & COBBLES			71A	-	31	-	-	-	17/5" 10/0" HAMMER BOUNCES
	LAVA ROCK W/ POCKETS OF BROWN CLAYEY SILT	5		71B	-	7	-	-	-	21/.3' HAMMER BOUNCES
		10		71C	NO	RECOVERY		-	-	20/0" HAMMER BOUNCES
		15		71D	NO	RECOVERY		-	-	20/0" HAMMER BOUNCES
	END OF BORING @ 15' ±									

* ELEVATION ESTIMATED FROM CONTOUR PLAN

WALTER LUM ASSOCIATES

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Boring Log

PROJECT: RESORT NO. 1

LOCATION: Maunalua, Oahu, Hawaii

Tax Map Key: 3-9-11

HAMMER:

Weight: 140#

Drop: 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 72 Sheet No. _____ of _____

Driller: WALTER LUM ASSOC. Date: AUGUST 24, 1970

Field Party: GLORY, ASATO, YAMAMOTO

Type of Boring: AUGER (MOBILE MINUTEMAN) Diam.: 3"

Elev.: 12' ± * Datum: —

Drill Bit: T.C. DRAG

Water Level				
Time	—			
Date	8-24-70			

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test, N (Blows per foot) 0 10 20 30 40
	ELEV. = 12' ± *	0								
(SM)	MEDIUM DENSITY, BROWN & WHITE, SILTY SAND W/COBBLES & CORAL GRAVEL	5		72-A	-	4	-	-	-	
				72-B	-	3	-	-	-	
(SP)	BROWN & WHITE, SAND	10		72-C	-	3	-	-	-	
	LAVA ROCK									
	END OF BORING @ 12.5'									

* ELEVATION ESTIMATED FROM CONTOUR PLAN

WALTER LUM ASSOCIATES

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Boring Log

PROJECT: RESORT NO. 1

LOCATION: Maunalua, Oahu, Hawaii

Tax Map Key: 3-9-11

HAMMER:

Weight: 140 #

Drop: 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 73 Sheet No. ____ of ____

Driller: W. Lum Assoc. Date: 4-1-70

Field Party: KAKU, GLORY

Type of Boring: AUGER (ACKER ACE) Diam.: 3

Elev.: 20'± * Datum: —

Drill Bit: T.C. DRAG

Water Level: NOT NOTICED

Time: —

Date: 4-1-70

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: STANDARD PENETRATION TEST, Blows Per Foot (0 10 20 30)
	ELEV. 20'± *	0								
	LOOSE, SILTY SAND W/GRAVEL & COBBLES			73A	NO	RECOVERY		-	-	10/0'
	LAVA ROCK W/ CLINKER POCKETS	5		73B	-	14	-	-	-	22/.3' HAMMER BOUNCES
	VOID (6.8' TO 7')			73C	NO	RECOVERY		-	-	20/0'
	LAVA ROCK	10		73D	NO	RECOVERY		-	-	20/0'
	END OF BORING @ 10'±									

* ELEVATION ESTIMATED FROM CONTOUR PLAN.

WALTER LUM ASSOCIATES

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: RESORT NO. 1

LOCATION: Maunalua, Oahu, Hawaii

Tax Map Key: 3-9-11

HAMMER:
Weight: 140#
Drop: 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 74 Sheet No. _____ of _____

Driller: W. Lum Assoc. Date: 4-2-70

Field Party: KAKU, MEYER

Type of Boring: AUGER (CONCORE A-5 Jr.) Diam.: 4"

Elev.: 15'± * Datum: —

Drill Bit: T.C. DRAG

Water Level: NOT NOTICED
Time: 12:00P.M.
Date: 4-2-70

Unified Soil Classification	DRILLING RATES	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: STANDARD PENETRATION TEST, Blows Per Foot (0 10 20 30)
SC		ELEV. 15'± *	0								
		LOOSE, BROWN, CLAYEY SAND W/CORAL FRAGMENTS			74A	NO	RECOVERY	-	-	-	20/0' HAMMER BOUNCES
		VOID (3' TO 3.2')									
			5		74B	NO	RECOVERY	-	-	-	30/.1' HAMMER BOUNCES
		LAVA ROCK									
		VOID (9.7' TO 10')	10		74C	NO	RECOVERY	-	-	-	20/0' HAMMER BOUNCES
		END OF BORING @ 10' *									

* ELEVATION ESTIMATED FROM CONTOUR PLAN.

WALTER LUM ASSOCIATES

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Boring Log

PROJECT: RESORT NO. 1

LOCATION: Maunalua, Oahu, Hawaii
Tax Map Key: 3-9-11

HAMMER:
Weight
Drop

SAMPLER:

BORING NO. 75 Sheet No. ____ of ____

Driller WALTER LUM ASSOC. Date AUGUST 24, 1970

Field Party GLORY, ASATO, YAMAMOTO

Type of Boring AUGER (MOBILE MINUTEMAN) Diam. 3"

Elev. 8'± * Datum —

Drill Bit T.C. DRAG

Water Level				
Time	—			
Date	8-24-70			

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test, N (Blows per foot) 0 10 20 30 40
	ELEV. = 8'± *	0								
SP	BROWN & WHITE, SAND				-	3	-	-	-	
	LAVA ROCK	5								
	END OF BORING @ 4.5'									
	* ELEVATION ESTIMATED FROM CONTOUR PLAN									

WALTER LUM ASSOCIATES

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Boring Log

PROJECT: RESORT NO. 1

LOCATION: Maunalua, Oahu, Hawaii
Tax Map Key: 3-9-11

HAMMER:
Weight
Drop

SAMPLER:

BORING NO. 76 Sheet No. ____ of ____

Driller: WALTER LUM ASSOC. Date: AUGUST 25, 1970

Field Party: GLORY, ASATO, LOK

Type of Boring: AUGER (MOBILE MINUTEMAN) Diam.: 3"

Elev.: 10' ± * Datum: —

Drill Bit: T.C. DRAG

Water Level				
Time	—			
Date	8-25-70			

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test, N (Blows per foot) 0 10 20 30 40
	ELEV. = 10' ± *	0								
(SP-SM)	WHITE & BROWN, SILTY SAND W/COBBLES, GRAVELS & CORALS			76-A	—	3	—	—	—	
(SM)	TAN, SILTY SAND W/ COBBLES & CORAL			76-B	—	10	—	—	—	
		5		76-C	—	8	—	—	—	
	LAVA ROCK									
	END OF BORING @ 7'									

* ELEVATION ESTIMATED FROM CONTOUR PLAN

WALTER LUM ASSOCIATES 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: RESORT NO. 1

LOCATION: Maunalua, Oahu, Hawaii

Tax Map Key: 3-9-11

HAMMER:

Weight:

Drop:

SAMPLER:

BORING NO. 77 Sheet No. ____ of ____

Driller WALTER LUM ASSOC. Date AUGUST 25, 1970

Field Party GLORY, ASATO, LOK

Type of Boring AUGER (MOBILE MINUTEMAN) Diam. 3"

Elev. 7' ± * Datum —

Drill Bit T.C. DRAG

Water Level					
	NOT NOTICED				
Time	—				
Date	8-25-70				

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test, N (Blows per foot) 0 10 20 30 40
	ELEV. = 7' ± *	0								
(SP)	WHITE, SAND W/CORAL & GRAVEL			77-A	—	1	—	—	—	
(SM)	TAN & BROWN, SILTY SAND W/COBBLES, CORAL & GRAVEL			77-B	—	9	—	—	—	
	LAVA ROCK	5		77-C	—	—	—	—	—	
	END OF BORING @ 5'									

* ELEVATION ESTIMATED FROM CONTOUR PLAN

WALTER LUM ASSOCIATES

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: RESORT NO. 1

LOCATION: Maunalua, Oahu, Hawaii

Tax Map Key: 3-9-11

HAMMER:
Weight: 140#
Drop: 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 78 Sheet No. ____ of ____

Driller: W. Lum Assoc. Date: 4-3-70

Field Party: KAKU, MEYER

Type of Boring: AUGER (CONCORE A-5 Jr) Diam.: 4"

Elev.: 17'± * Datum: —

Drill Bit: T.C. DRAG

Water Level: NOT NOTICED

Time: —

Date: 4-3-70

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: STANDARD PENETRATION TEST, Blows Per Foot (0 10 20 30)
	ELEV. 17'± *	0								
(SM)	SURFACE: TANNISH WHITE SAND & CORAL FRAGMENTS W/ EXPOSED LAVA ROCK BROWN SILTY SAND W/ DECOMPOSED LAVA ROCK			78A	-	13 8	-	-	-	40
	DECOMP. ROCK, BROWN SILTY CLAY	5		78B	ROCK FRAGMENT					10/5" — 50/0" HAMMER BOUNCES
	VOID (6.2' TO 7')									
(SM)	LIGHT BROWN LAVA ROCK W/ BROWN SILTY CLAY & GRAVEL			78C	-	14	-	-	-	
		10								
	BROWN LAVA ROCK			78D	ROCK FRAGMENT					40/.1' HAMMER BOUNCES
		15		78E	NO RECOVERY					20/0' HAMMER BOUNCES
	END OF BORING @ 15'±									

* ELEVATION ESTIMATED FROM CONTOUR PLAN

WALTER LUM ASSOCIATES

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: RESORT NO. 1

LOCATION: Maunalua, Oahu, Hawaii

Tax Map Key: 3-9-11

HAMMER:
Weight: 140#
Drop: 30"

SAMPLER: 2-SS - 2" STANDARD SPLIT SPOON
2-S - 2" OD THIN WALL TUBE

BORING NO. 79 Sheet No. _____ of _____

Driller: W. Lum Assoc. Date: 4-7-70

Field Party: SETO, GLORY

Type of Boring: AUGER (ACKER ACE) Diam.: 3"

Elev.: 5'± * Datum: —

Drill Bit: T. C. DRAG

Water Level: 4.0'
Time: 1:15 PM
Date: 4-7-70

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test, Blows Per Foot (0 10 20 30)	PENETRATION DATA: 2" OD THIN WALL TUBE, BLOWS/0.5'
	ELEV. 5'± *	0									
MH	BROWN SILTY CLAY w/ SAND, GRAVEL & COBBLES		2SS	79A	-	27 42	-	-	-	-	
	STIFF, MOTTLED RED BROWN		4-7-70 WATER								
SM	SILTY SAND	5									
	DECOMPOSED ROCK		2S	79B	104	78	59	1820	-	-	8/.5' 8/.3'
			2SS	79C	ROCK FRAGMENT				-	-	20/.1'
	END OF BORING @ 9.5'	10									

* ELEVATION ESTIMATED FROM CONTOUR PLAN

RESORT NO. 1

TABLE I A - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	71	74	79	79
SAMPLE NO.			A	B
DEPTH BELOW SURFACE	SURFACE	SURFACE	0.5'-2.0'	5.0'-6.3
DESCRIPTION	BROWN SILTY SAND W/GRAVEL	BROWN CLAYEY SAND W/CORAL FRAGS	BROWN SILTY CLAY W/ SAND	MOTTLED REDDISH-BROWN SILTY SAND
GRAIN-SIZE ANALYSIS (% Passing)				
Sieve 1½"	88.7	95.4		
1"	85.2	88.2		100
1/2"	75.8	83.6		100
#4	72.7	76.7		100
#10	70.3	67.9		959
#20	66.4	56.1		839
#40	22.3	41.6		68.7
#100	12.5	30.2		46.5
#200	10.9	26.2		37.7
ATTERBERG LIMITS				
Air Dried or Natural		NATURAL	NATURAL	NATURAL
Liquid Limit		45	77	65
Plastic Limit	NONPLASTIC	21	37	45
Plasticity Index		24	40	20
Dilatancy		SLOW		QUICK
Toughness		MEDIUM	MEDIUM	SLIGHT
Dry Strength		MEDIUM	MEDIUM	SLIGHT
UNIFIED SOIL CLASSIFICATION	SP-SM	SC	MH	SM
APPARENT SPECIFIC GRAVITY		2.95		
EXPANSION AND CBR TESTS (Surcharge-51 P.S.F.)				
Molding Moisture, %	12.1	15.0		
Molding Dry Density, P.C.F.	100.9	115.3		
Swell upon saturation, %	NIL	1.0		
CBR at 0.1" Penetration	49.0	52.0		
MOISTURE-DENSITY RELATIONS OF SOILS (AASHO T-180-57 Method)		D		
Dry to Wet or Wet to Dry		DRY TO WET		
Max. Dry Density (P.C.F.)		115.3		
Optimum Moisture (%)		14.9		

REMARKS:

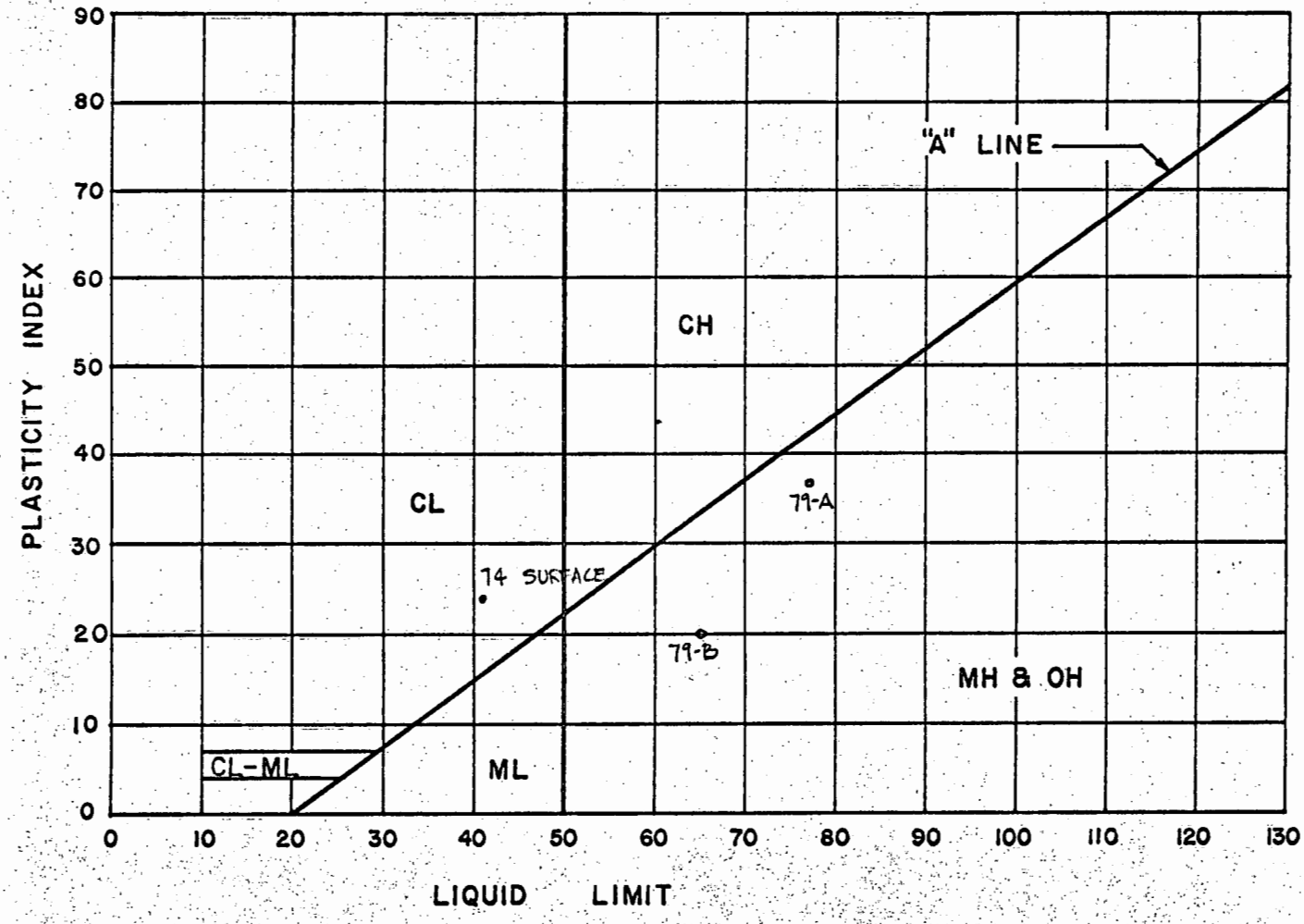
WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

Date 8-14-70 By BT

PLASTICITY CHART

PROJECT: RESORT NO. 1

LOCATION: MAUNALUA, OAHU, HAWAII



WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

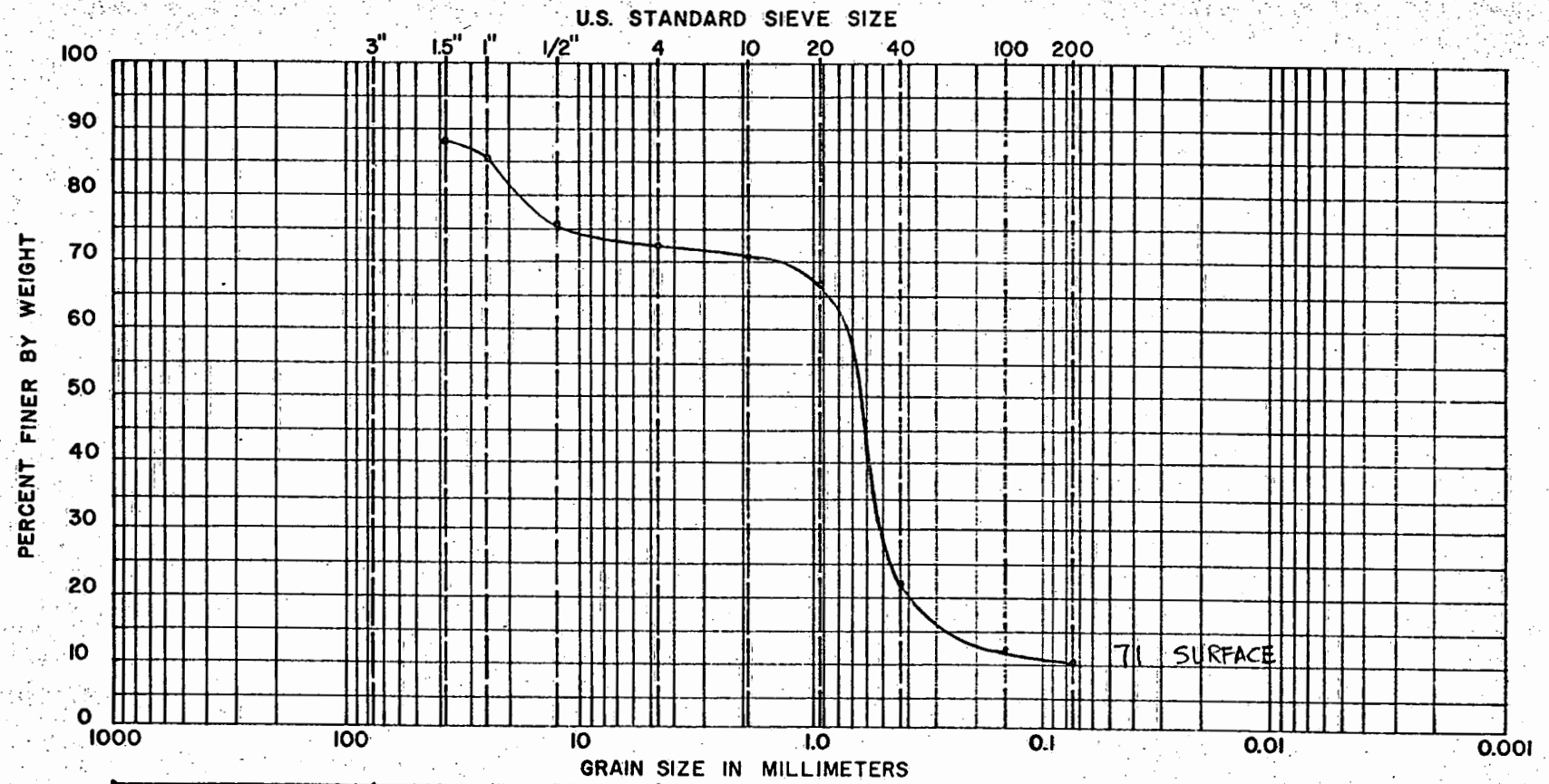
DATE 8-14-70 BY BT.

13-570

GRAIN-SIZE ANALYSIS CURVE

PROJECT: RESORT NO. 1

LOCATION: MAUNALUA, OAHU, HAWAII



COBBLE	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

DATE 8-14-70 BY BJ.

MOISTURE–DENSITY CURVE (AASHO T-180-57, METHOD D)

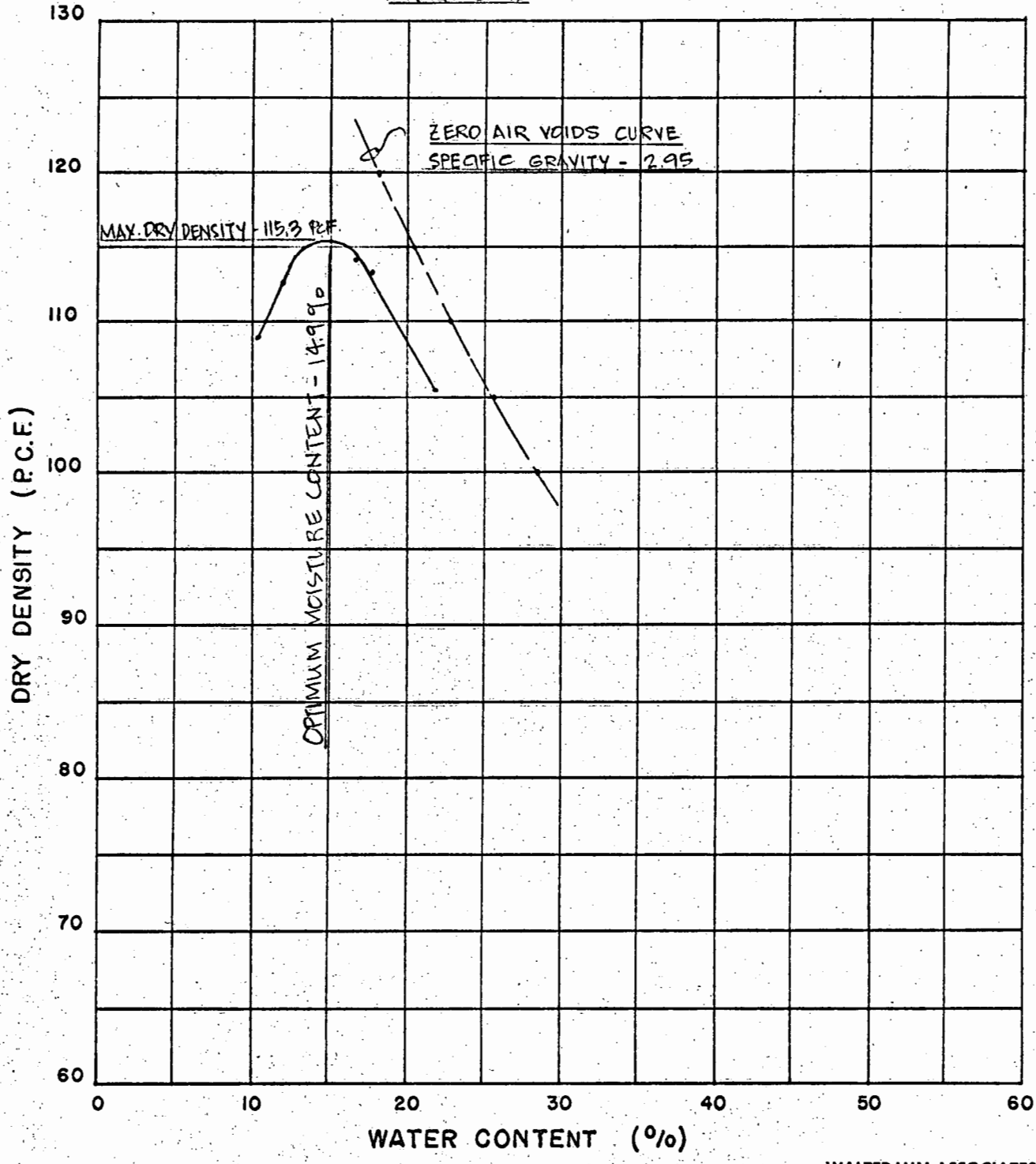
PROJECT: RESORT No. 1

LOCATION: MAUNALUA , OAHU , HAWAII

SAMPLE NO.: 74 -SURFACE

SAMPLE DESCRIPTION: BROWN CLAYEY SAND W/ CORAL FRAGMENTS

AGGREGATE: 3/4" MINUS
MOLD SIZE: 6" ϕ 4.59"
HAMMER: 10 LBS. 18" DROP
LAYERS: 5
BLOWS: 56 PER LAYER



WALTER LUM ASSOCIATES, INC.
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DATE 7-31-70 BY S.T.

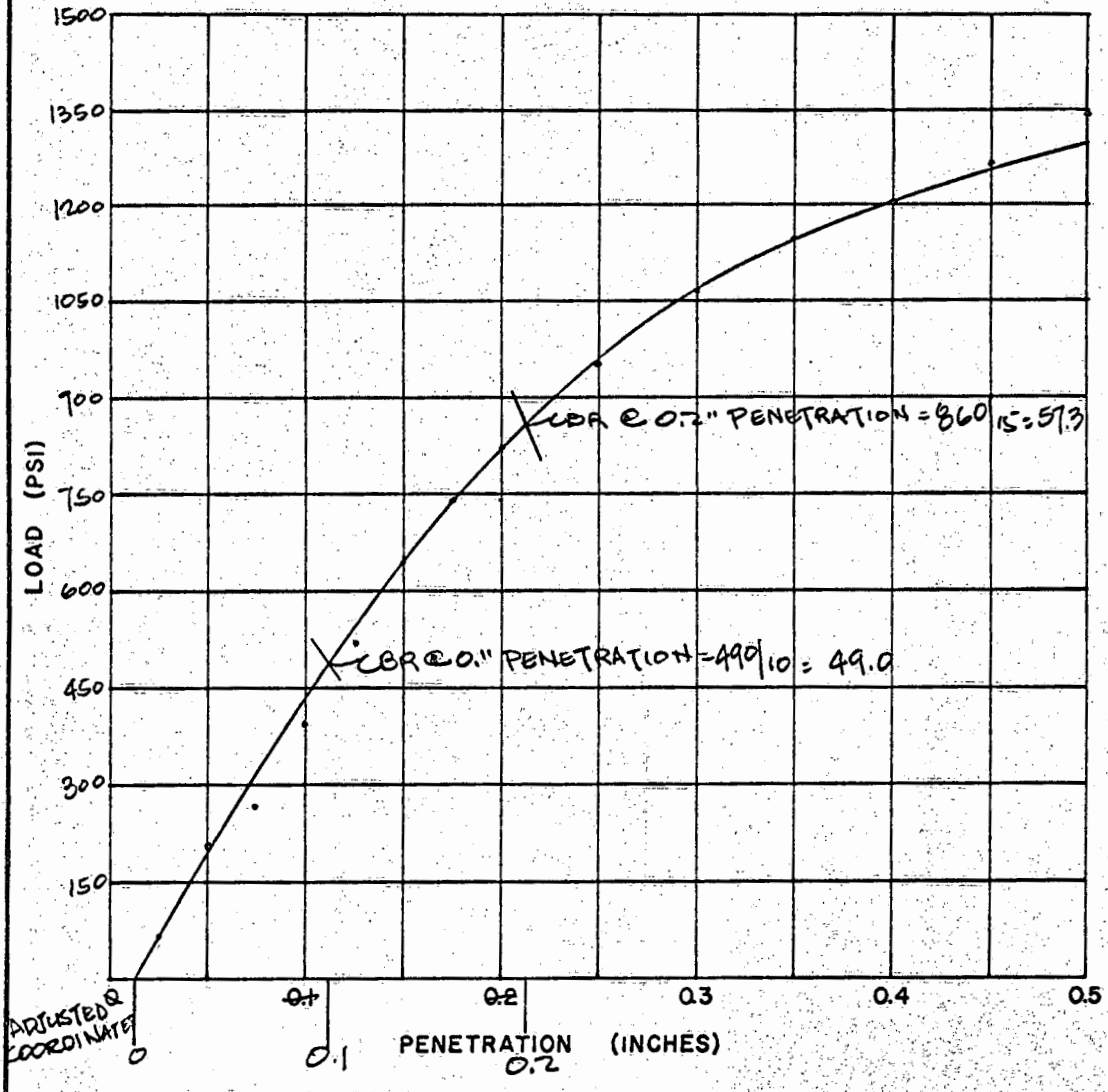
CBR TEST

PROJECT: RESORT No. 1

LOCATION: MAUNALUA, OAHU, HAWAII

SAMPLE NO: 71 SURFACE

SAMPLE DESCRIPTION: BROWN SILTY SAND W/ GRAVEL



CBR PENETRATION DATA

PENETRATION (INCHES)	LOAD (LBS.)	LOAD (PSI)
0.025	200	67
0.050	465	155
0.075	800	267
0.100	1195	398
0.125	1570	523
0.150	1923	645
0.175	2230	743
0.200	2470	823
0.250	2870	957
0.300	3200	1067
0.350	3450	1150
0.400	3615	1205
0.450	3805	1268
0.500	4020	1340

AGGREGATE 1/4" MINUS

HAMMER WEIGHT 10 LBS.

HAMMER DROP 18"

No. OF BLOWS 56

No. OF LAYERS 5

TEST RESULTS:

MOLDING MOISTURE, %. 12.1

MOLDING DRY DENSITY, P.C.F. 100.6

CBR @ 0.1" PENETRATION 49.0

DATE 7-28-70 BY A.F.

DATE 8-3-70 BY S.T.

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

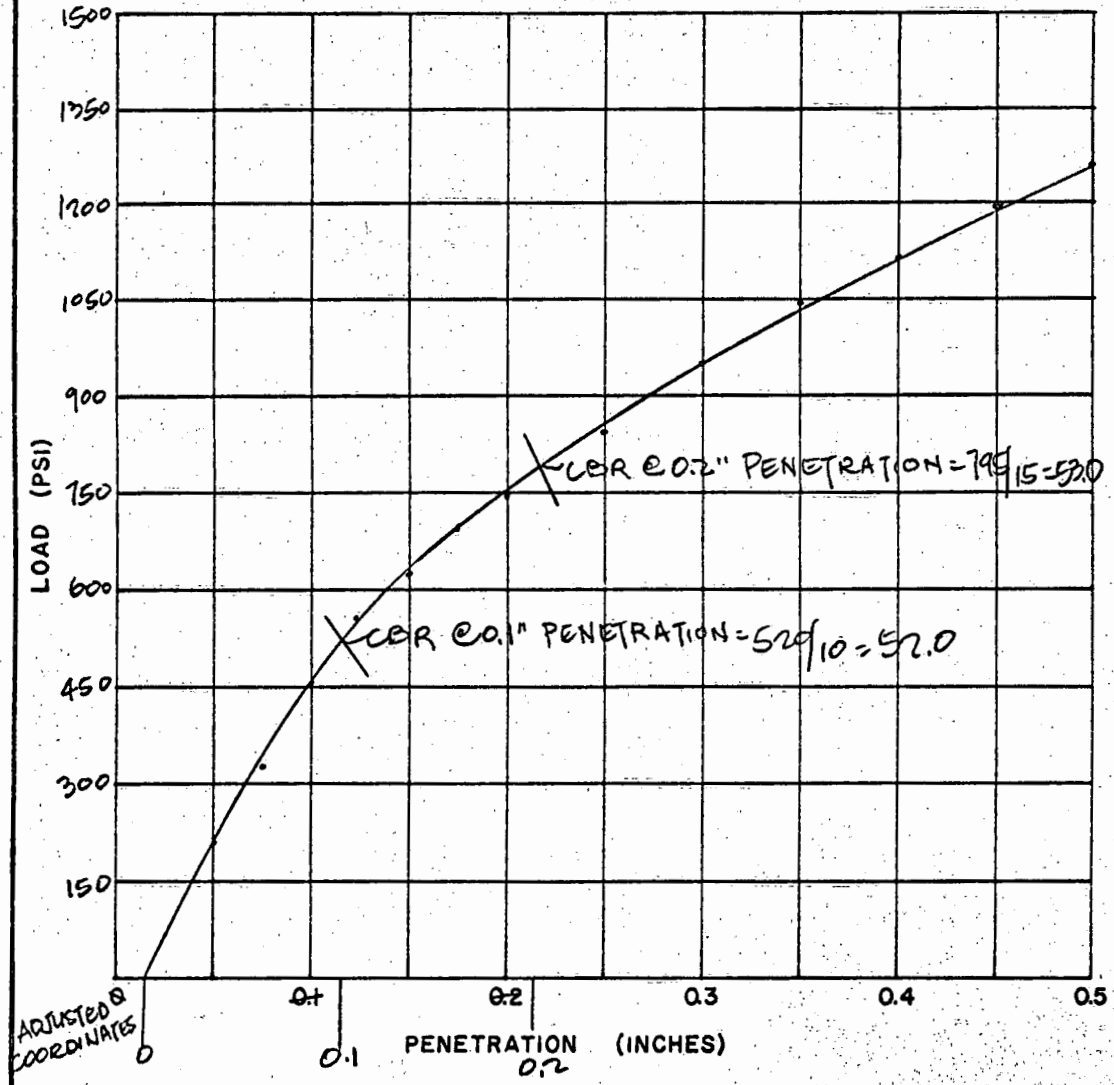
CBR TEST

PROJECT: RESORT NO. 1

LOCATION: MAUNALUA, OAHU, HAWAII

SAMPLE NO: 74 SURFACE

SAMPLE DESCRIPTION: BROWN CLAYEY SAND W/ CORAL FRAGMENTS



CBR PENETRATION DATA

PENETRATION (INCHES)	LOAD (LBS.)	LOAD (PSI)
0.025	205	68
0.050	600	200
0.075	1070	340
0.100	1380	460
0.125	1655	552
0.150	1880	627
0.175	2080	693
0.200	2230	743
0.250	2570	857
0.300	2850	950
0.350	3135	1045
0.400	3370	1123
0.450	3590	1197
0.500	3805	1268

AGGREGATE 1/4" MINUS

HAMMER WEIGHT 10 LBS

HAMMER DROP 18"

No. OF BLOWS 56

No. OF LAYERS 5

TEST RESULTS:

MOLDING MOISTURE, %. 15.0

MOLDING DRY DENSITY, P.C.F. 115.3

CBR @ 0.1" PENETRATION 52.0

DATE 7-28-70 BY C.M.

DATE 8-4-70 BY S.T.

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

10-470

GENERAL TESTING METHODS

EXPLORATORY BORINGS AND SAMPLING

Method for soil investigation and sampling by auger borings (Tentative)	ASTM Designation: D 1452-63T
Method for thin wall tube sampling of soils (Tentative)	ASTM Designation: D 1587-63T
Method for penetration test and split barrel sampling of soils (Tentative)	ASTM Designation: D 1586-64T

LABORATORY TESTING

Grading Analysis

Sieve analysis of fine and coarse aggregates	AASHO Designation: T 27-60
Amount of material finer than No. 200 sieve in aggregate	AASHO Designation: T 11-60

Atterberg Limits

Determining the liquid limit of soils Modified as follows: Substitute Casagrande grooving tool. Tests conducted from natural moisture content unless noted otherwise.	AASHO Designation: T 89-60
Determining the plastic limit of soils	AASHO Designation: T 90-56
Calculating the plasticity index of soils	AASHO Designation: T 91-54

Specific Gravity

Specific gravity of soils Modified as follows: 500 ML Pycnometer	AASHO Designation: T 100-60

Expansion and CBR Tests

Expansion test and California Bearing Ratio (CBR)	Section VIII - TM 5-530 "Materials Testing" by Headquarters, Dept. of the Army

Compaction Test

Moisture-Density relations of soils using a 10# rammer and an 18" drop	AASHO Designation: T 180-57

Unified Soil Classification

Designation E-3 from "Earth Manual" by the United States Department of the Interior Bureau of Reclamation

GENERAL TESTING METHODS

Consolidation Test

Chapter IX
"Soil Testing for Engineers"
by T. William Lambe
The Massachusetts Institute
of Technology

Laboratory Shear Test

Laboratory shear test using the Torvane

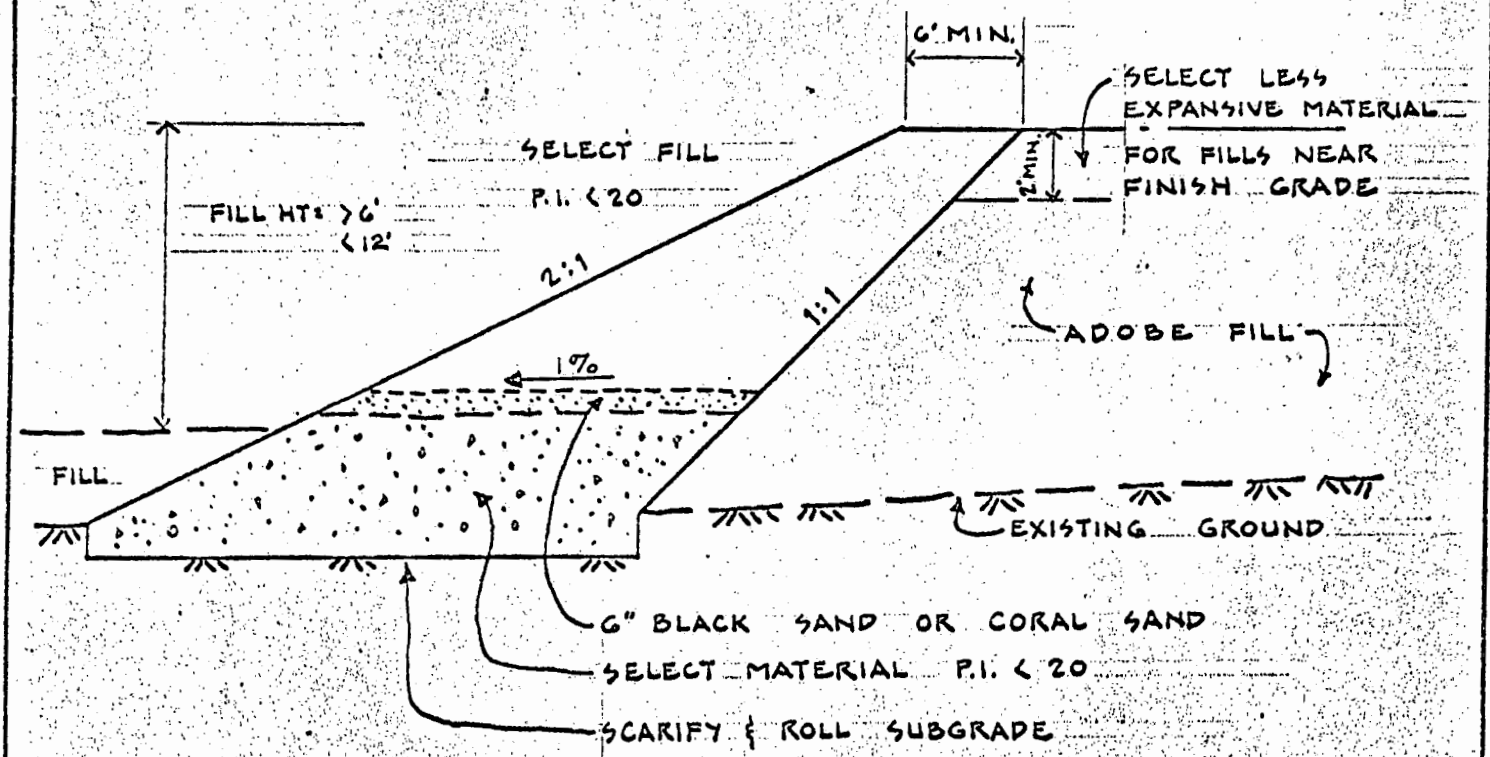
Brochure by Soiltest, Inc.

LIMITATIONS

In general, soil formations are commonly erratic and rarely uniform or regular. The boring logs indicate the approximate subsurface soil conditions encountered only at the drill holes where the borings were made at the times designated on the logs and may not represent conditions at other locations or at other dates. Soil conditions and water levels may change with the passage of time and construction methods or improvements at the site.

During construction, should subsurface conditions much different from those in the borings be observed, encountered, or otherwise indicated, we should be advised immediately to review or reconsider our recommendations in light of the new developments.

Our professional services were performed, findings obtained and recommendations prepared in accordance with generally accepted engineering practices. This warranty is in lieu of all other warranties expressed or implied.



SECTION

NOT TO SCALE

FIGURE 2

TYPICAL SLOPE TREATMENT FOR CUTS & FILLS IN ADOBE

RESORT NO. 1

MAUNALUA, OAHU, HAWAII

TAX MAP KEY: 3-9-11

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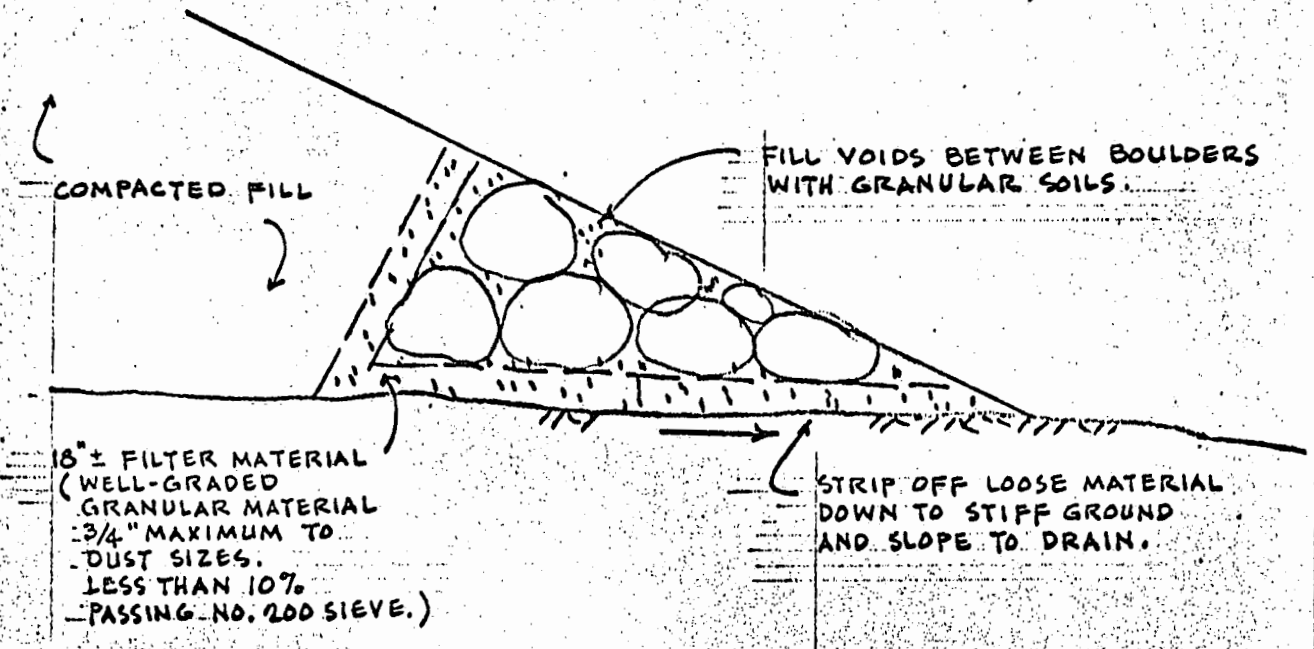
AUGUST, 1970



SECTION

NOT TO SCALE

FIGURE 3

PROPOSED BOULDER FILL

RESORT NO. 1

MAUNALUA, OAHU, HAWAII

TAX MAP KEY: 3-9-11

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